Table 1. Effect of aging (250°C for 1hr) on the mechanical properties of new alloys

Alloy	State	TYS MPa	UTS MPa	E%	CYS MPa	MCR·10^9, S^{-1}		CR mg/cm^2/day
						150°C 100 MPa	200°C 55 MPa	
Example 3	F	183	237	4	183	0.84	1.05	1.58
	T5	195	250	5	195	0.82	1.08	1.53
Example 6	F	179	240	5	179	1.44	2.54	1.38
	T5	200	255	5	198	1.28	2.35	1.41
Example 8	F	188	236	5	186	1.05	1.95	1.35
	T5	197	243	3	198	1.02	1.97	1.32
Example 14	F	195	234	3	193	1.31	2.40	1.35
	T5	203	250	3	202	1.18	2.28	1.37

Fig. 1

Table 2. Chemical Compositions of Alloys

Alloy	Al %	Mn %	Zn %	Ca %	Sn %	Sr %	Si %	Fe %	Ni %	Cu %	Be %
Example 1	4.7	0.29	-	1.9	1.8	0.3	0.01	0.002	0.0006	0.0005	-
Example 2	5.3	0.31	0.3	1.8	0.3	-	0.01	0.002	0.0005	0.0006	0.0005
Example 3	5.1	0.30	-	2.9	1.0	-	0.01	0.003	0.0006	0.0006	-
Example 4	4.9	0.30	-	2.0	2.0	0.3	0.01	0.003	0.0005	0.0005	-
Example 5	5.2	0.31	-	3.1	0.5	-	0.01	0.002	0.0007	0.0004	0.0007
Example 6	6.1	0.29	0.6	2.2	2.0	-	0.01	0.002	0.0006	0.0006	-
Example 7	6.2	0.30	-	2.1	0.5	0.3	0.01	0.003	0.0006	0.0005	-
Example 8	6.2	0.28	-	2.8	1.5	-	0.01	0.003	0.0007	0.0005	-
Example 9	5.9	0.26	-	3.0	0.5	0.3	0.01	0.002	0.0005	0.0006	-
Example 10	6.6	0.25	-	1.9	1.5	0.5	0.01	0.003	0.0006	0.0005	-
Example 11	7.1	0.26	-	2.0	0.5	-	0.01	0.003	0.0006	0.0006	-
Example 12	7.0	0.23	0.8	2.1	2.0	-	0.01	0.002	0.0005	0.0005	-
Example 13	7.3	0.24	-	3.1	0.7	-	0.01	0.003	0.0006	0.0005	0.0004
Example 14	7.1	0.21	0.7	3.0	1.1	-	0.01	0.002	0.0005	0.0005	-
Comparative Example 1	8.9	0.23	0.74	-	-	-	0.01	0.002	0.0007	0.0009	0.0009
Comparative Example 2	4.3	0.29	0.01	2.4% RE	-	-	0.01	0.002	0.0008	0.0008	0.0008
Comparative Example 3	4.1	0.34	-	1.5	-	0.10	0.01	0.002	0.0005	0.0007	0.0009
Comparative Example 4	5.5	0.31	-	2.7	-	0.15	0.01	0.003	0.0006	0.0008	0.0008
Comparative Example 5	7.9	0.24	0.7	2.2	1.0	-	0.01	0.003	0.0008	0.0007	-

Fig. 2

Table 3. Die castability properties of new alloys

Alloy	Metal temperature [°C]	Oxidation resistance	Fluidity	Die sticking	Rank
Example 1	670	10	9	9	91.7
Example 2	690	10	10	8	86.7
Example 3	675	10	9	8	85.1
Example 4	680	10	10	9	93.3
Example 5	670	10	9	9	91.7
Example 6	670	10	9	10	98.4
Example 7	660	10	9	9	91.7
Example 8	660	10	9	9	91.7
Example 9	670	10	10	9	93.3
Example 10	675	10	10	9	93.3
Example 11	660	10	10	9	93.3
Example 12	660	10	10	10	100
Example 13	660	10	10	9	93.3
Example 14	660	10	10	9	93.3
Comparative Example 1	670	9	10	10	98.4
Comparative Example 2	690	8	8	9	80
Comparative Example 3	690	10	8	5	60
Comparative Example 4	675	10	9	7	78.3
Comparative Example 5	660	10	10	9	93.3

Fig. 3

Table 4. Intermetallic Phases in New Alloys

Alloy	Phase composition
Example 1	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_2(Ca,Sr)$, $Al_2(Ca,Sn,Sr)$, $Al_{0.54}Mn_{0.06}$
Example 2	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.56}Mn_{0.44}$
Example 3	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.55}Mn_{0.45}$
Example 4	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_2(Ca,Sr)$, $Al_2(Ca,Sn,Sr)$, $Al_{0.53}Mn_{0.47}$
Example 5	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.58}Mn_{.42}$
Example 6	Mg-Al-Zn-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.61}Mn_{0.39}$
Example 7	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sr)$, $Al_2(Ca,Sn)$, $Al_2(Ca,Sn,Sr)$, $Al_{0.59}Mn_{0.41}$
Example 8	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.63}Mn_{0.37}$
Example 9	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_2(Ca,Sr)$, Al2(Ca,Sn,Sr), $Al_{0.62}Mn_{0.38}$
Example 10	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sr)$, $Al_2(Ca,Sn,Sr)$
Example 11	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.64}Mn_{0.36}$
Example 12	Mg-Al-Zn-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.65}Mn_{0.35}$
Example 13	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.62}Mn_{0.38}$
Example 14	Mg-Al-Sn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$, $Al_{0.64}Mn_{0.36}$
Comparative example 1	Mg-Al_{ss}, $Mg_{17}(Al,Zn)_{12}$, Al_8Mn_5
Comparative example 2	Mg-Al_{ss}, $Al_{11}RE_3$, $Al_{10}RE_2Mn_7$
Comparative example 3	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sr)$, $Al_{0.58}Mn_{0.42}$
Comparative example 4	Mg-Al_{ss}, Al_2Ca, $Al_2(Ca,Sr)$, $Al_{0.54}Mn_{0.46}$
Comparative example 5	Mg-Al-Sn-Zn_{ss}, Al_2Ca, $Al_2(Ca,Sn)$

Fig. 4

Table 5. Mechanical Properties and Creep Behavior

Alloy	TYS Mpa			UTS MPa	E %	CYS MPa			MCR·10^9, S^{-1}		CR mg/cm^2/day
	20°C	175°C	200°C	20°C	20°C	20°C	175°C	200°C	150°C, 100 MPa	200°C, 55 MPa	
Example 1	175	160	145	227	5	172	155	143	1.30	1.96	1.52
Example 2	172	158	142	235	5	175	159	146	1.25	1.85	1.50
Example 3	183	165	154	237	4	183	165	155	0.84	1.05	1.58
Example 4	170	161	142	236	6	171	160	143	1.05	1.40	1.48
Example 5	180	168	152	235	4	179	168	153	0.80	1.08	1.56
Example 6	179	165	145	240	5	179	164	147	1.44	2.54	1.38
Example 7	178	163	148	238	5	176	163	146	1.39	2.44	1.45
Example 8	188	170	155	236	5	186	169	155	1.05	1.95	1.37
Example 9	186	172	157	232	4	186	172	157	0.95	1.88	1.49
Example 10	179	162	145	250	5	180	160	146	1.65	4.50	1.54
Example 11	180	160	143	248	5	179	160	142	1.64	4.80	1.32
Example 12	183	165	145	245	4	185	163	144	1.59	4.55	1.45
Example 13	196	170	158	230	3	192	170	157	1.25	2.25	1.47
Example 14	195	174	160	234	3	193	173	161	1.31	2.40	1.32
Comparative Example 1	160	88	75	260	6	158	86	75	1426	2890	1.31
Comparative Example 2	135	88	85	240	12	136	90	86	784	463	1.62
Comparative Example 3	160	148	138	225	3	155	147	136	1.82	4.72	1.59
Comparative Example 4	179	160	145	220	3	178	161	144	0.87	1.67	1.47
Comparative Example 5	195	168	153	230	1	192	165	150	1.75	5.6	1.39

Fig. 5

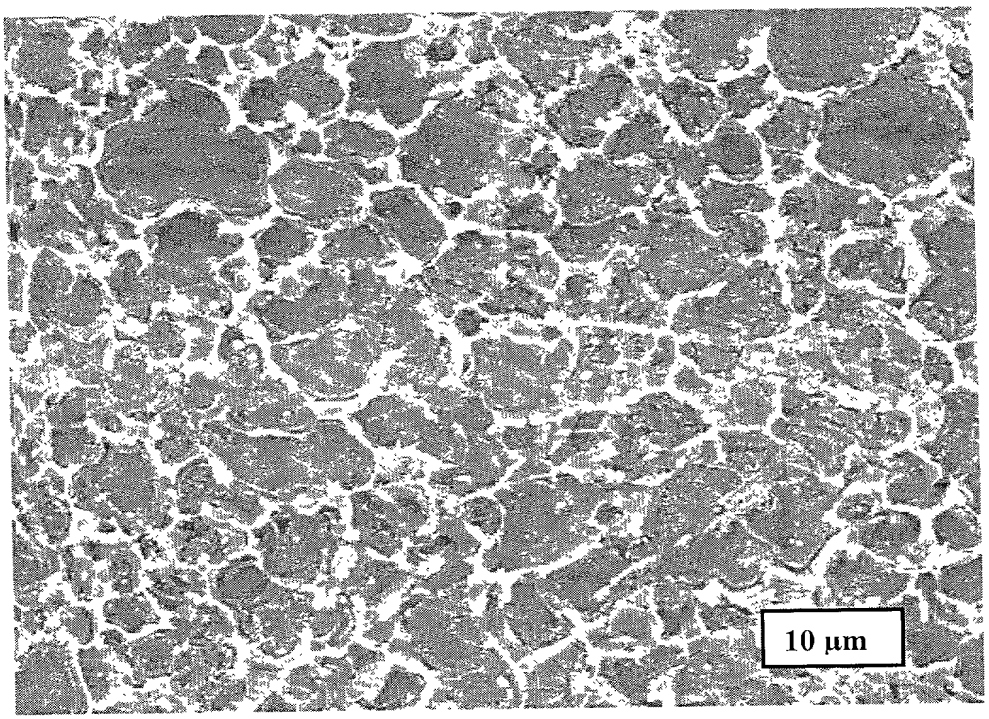

Fig. 6A

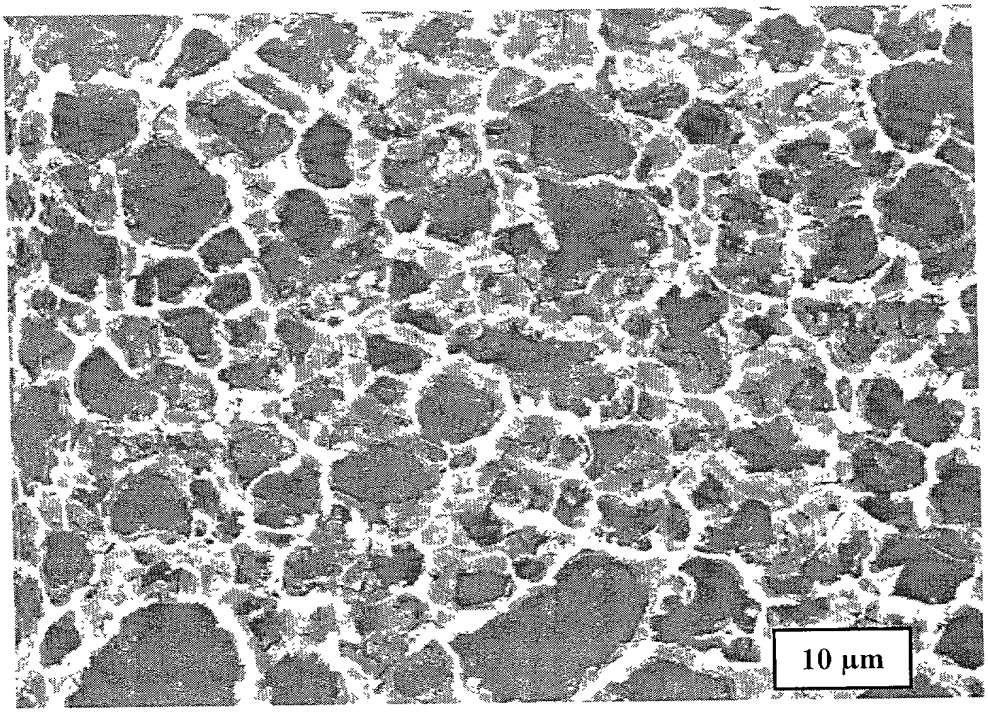

Fig. 6B

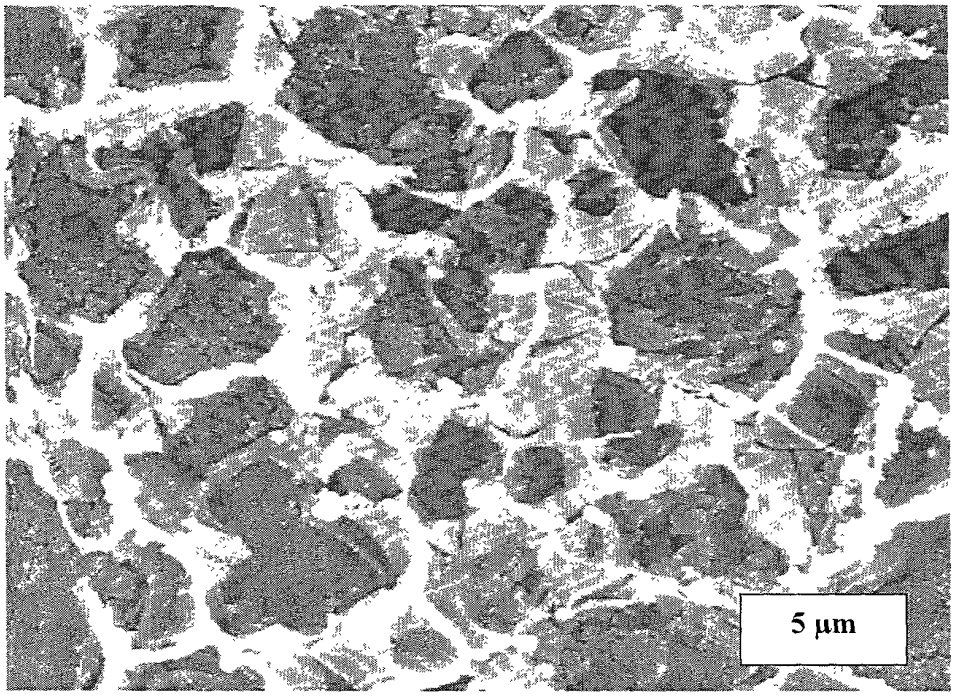

Fig. 7A

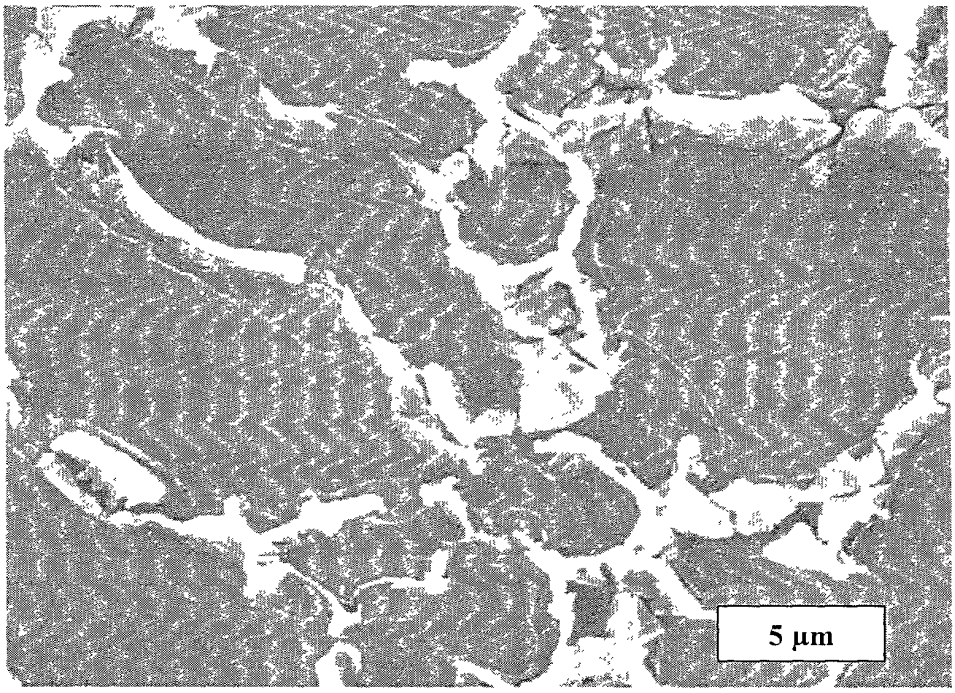

Fig. 7B

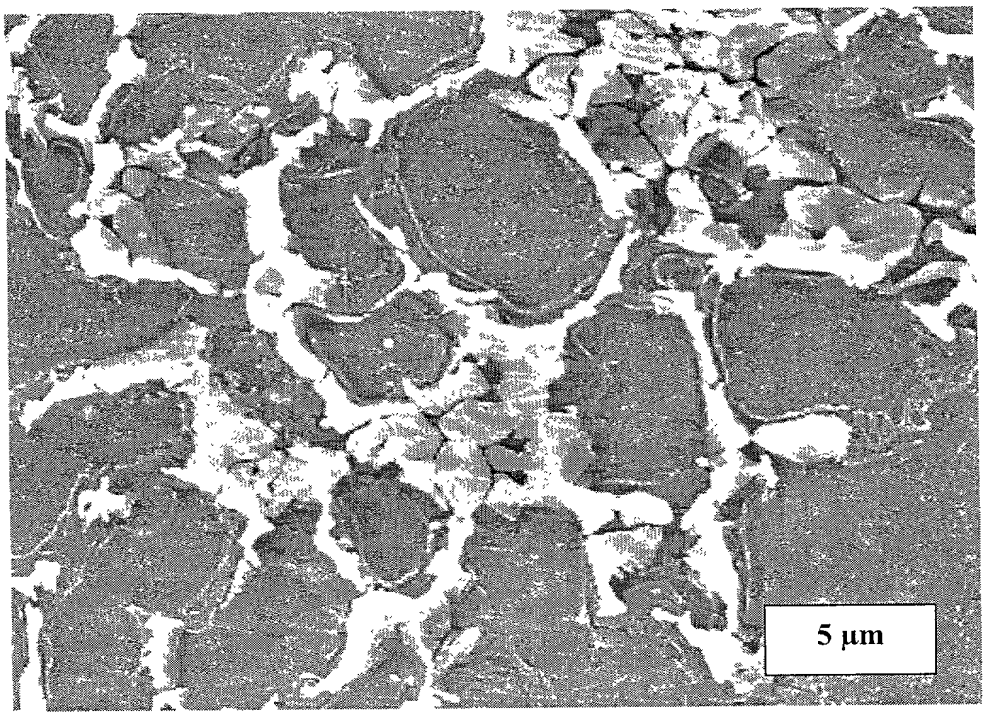

Fig. 8A

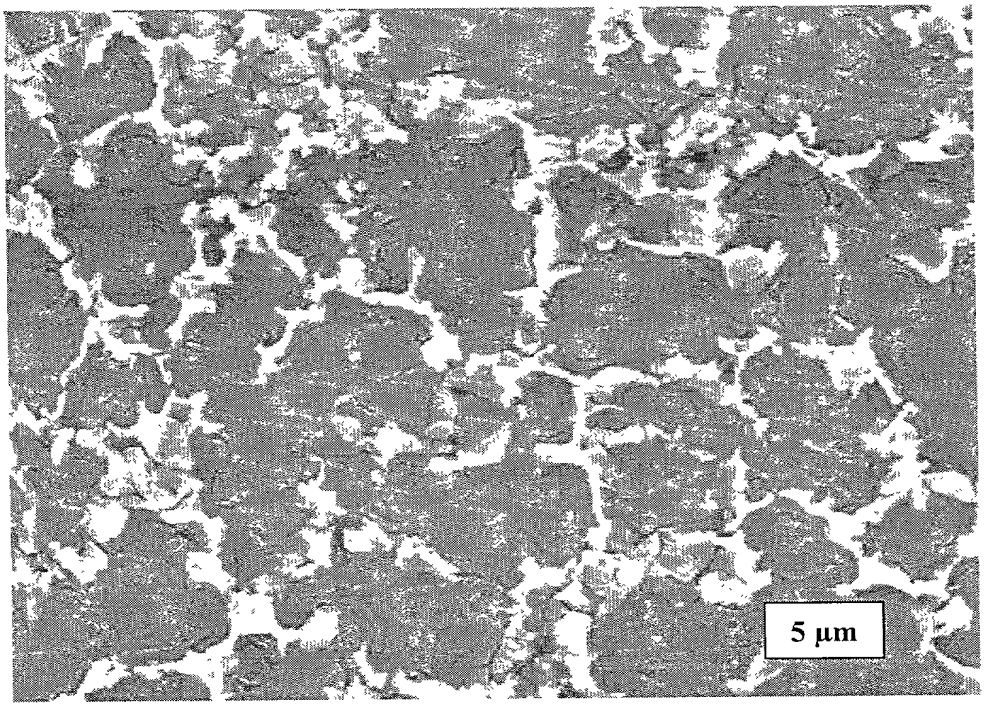

Fig. 8B

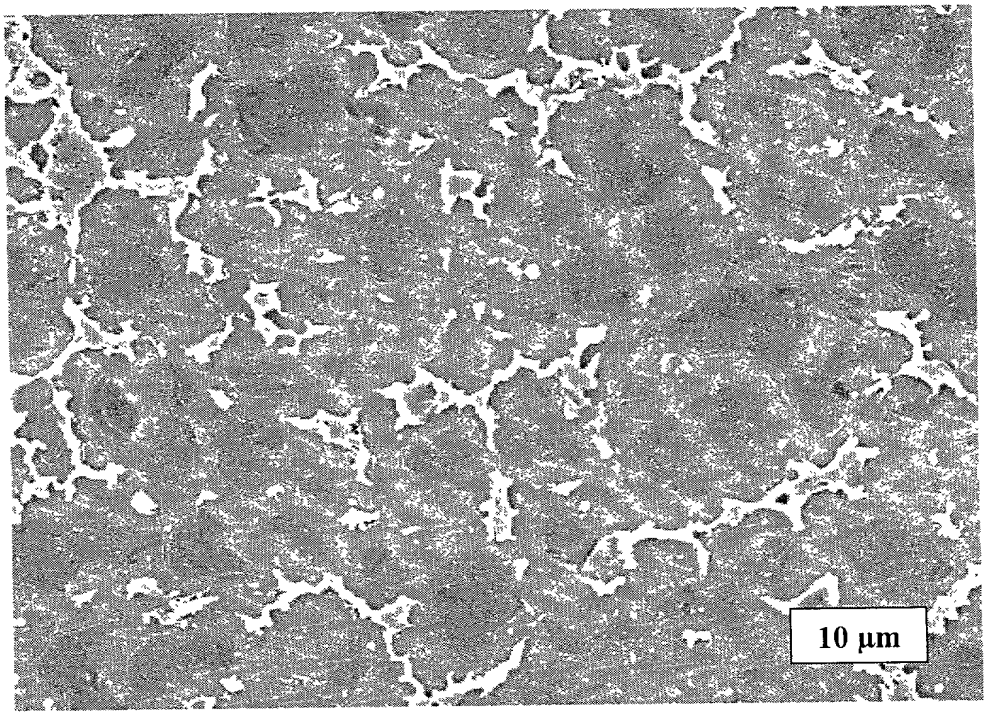

Fig. 9A

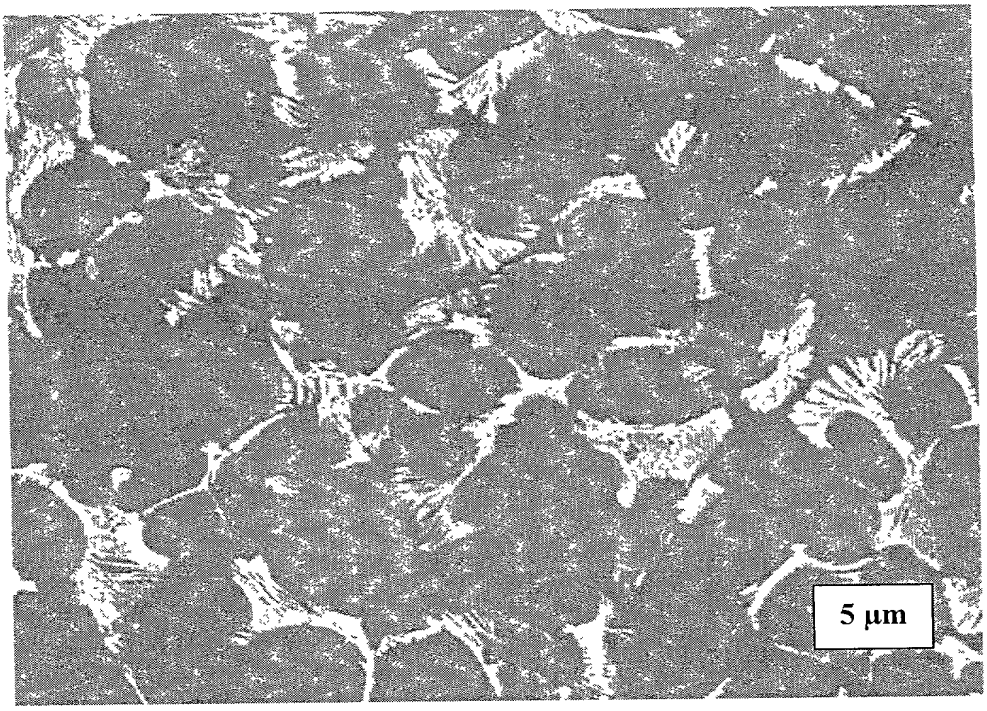

Fig. 9B